Using Hand Movements to Turn on my Electricity

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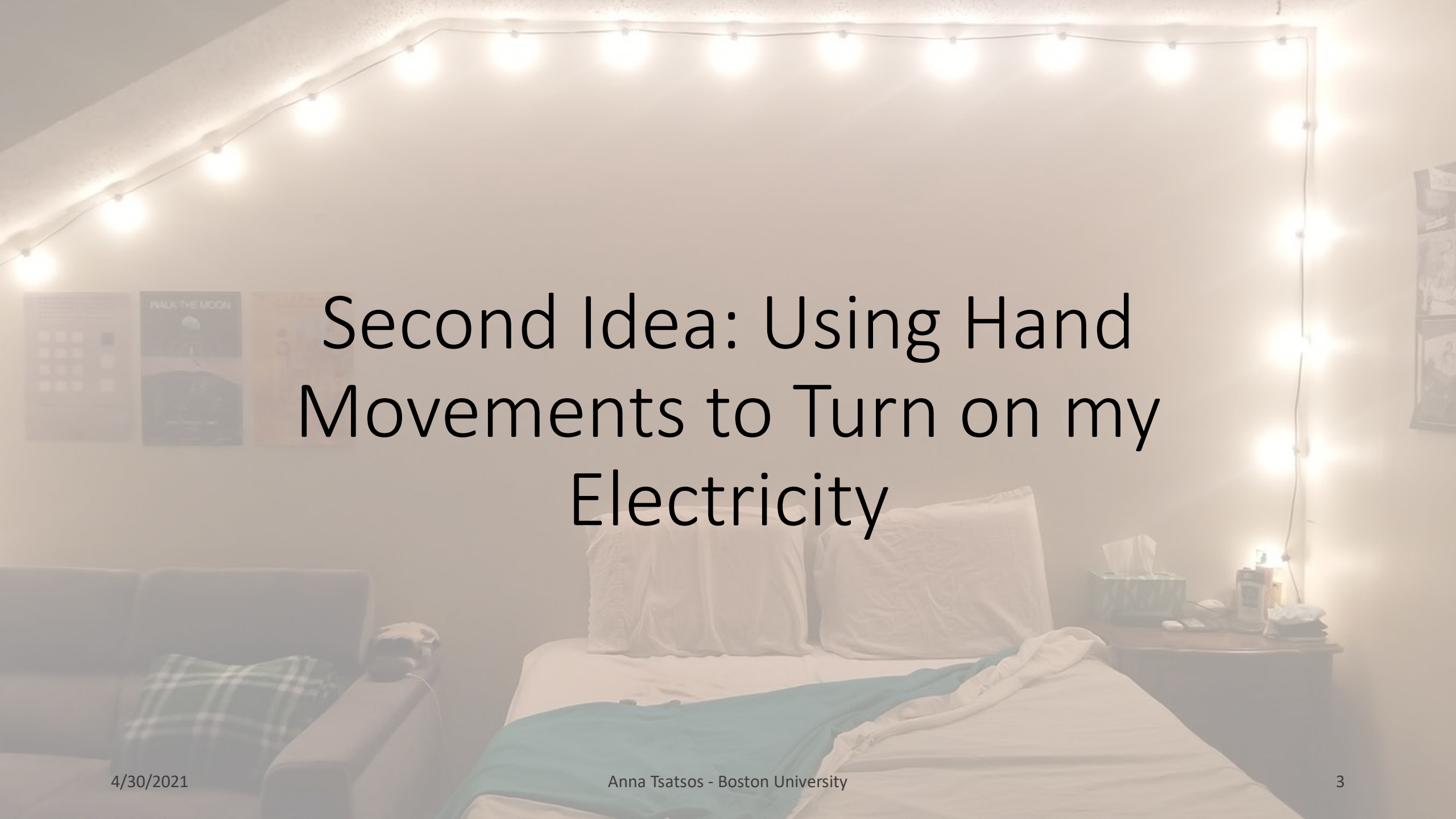
But why?

Two words: Home Improvement.

- Problem: String lights are **tasking** to plug in and out every time I want to use them.

- Solution: A switch to control lights, preferably one I can use while seated at my desk.
  - First idea: Clapper type switch with sound activation
  - Second idea: Motion sensor switch



Second Idea: Using Hand Movements to Turn on my Electricity

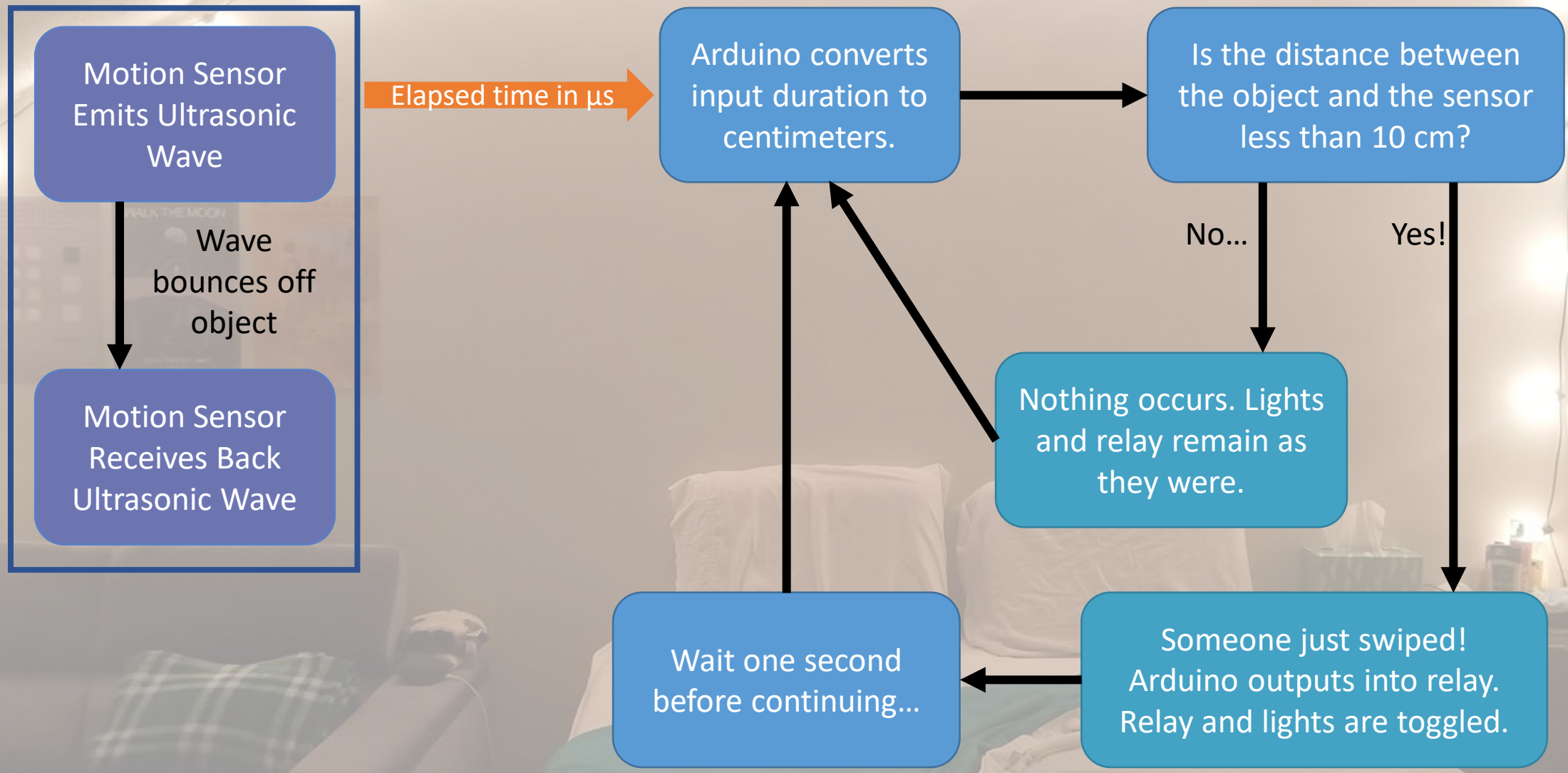
Second Idea: Motion Sensing

- Ultrasonic (motion) sensor sends out and receives back its own ultrasonic waves.
- In contrast, sound sensor uses microphone which takes in sounds including – but not limited to – clapping.

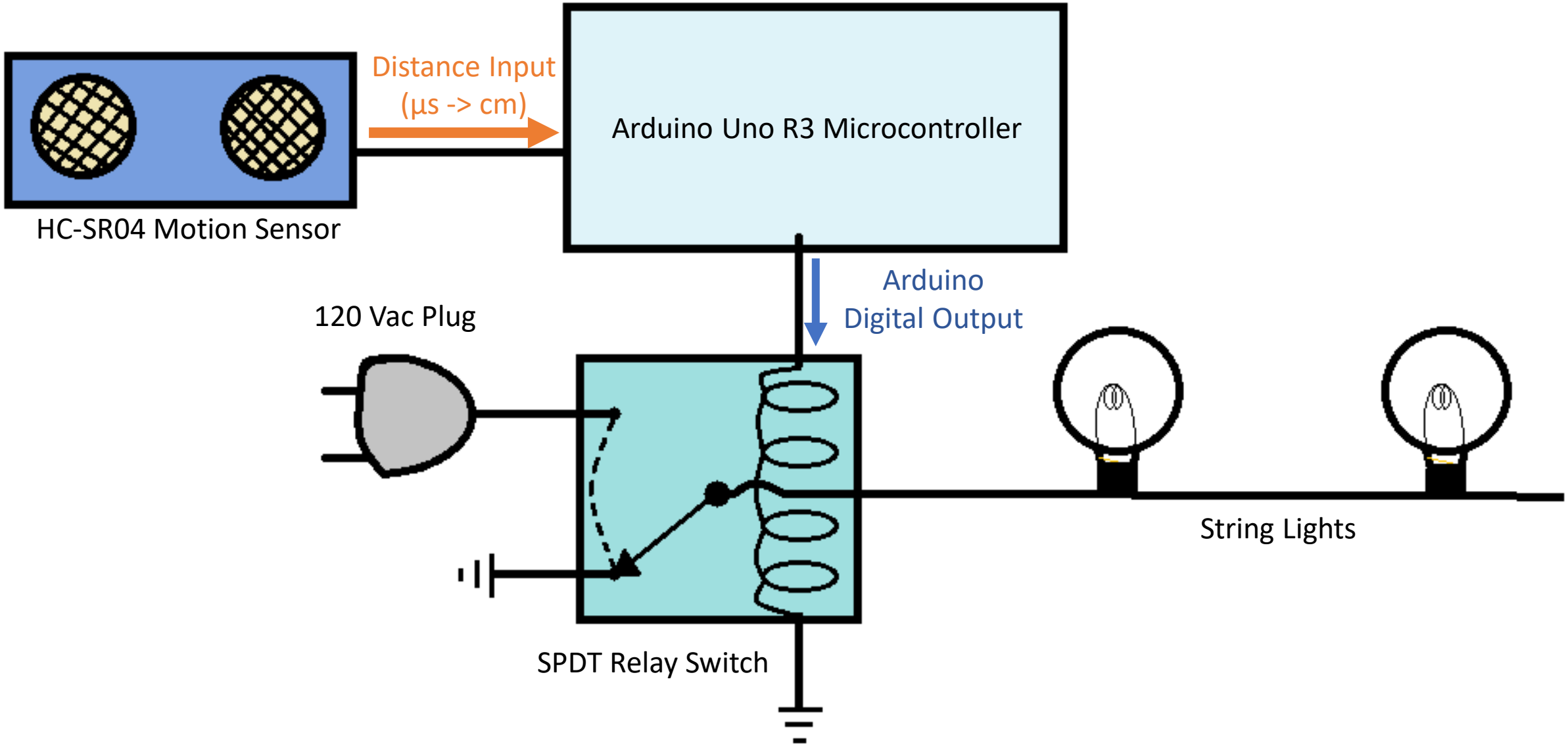
Pros and Cons

- Variety of noises made in daily routine aren't interruptive.
- Doesn't wake the roommates when lights are turned off at night.
- Still have to walk over to sensor to toggle the lights.

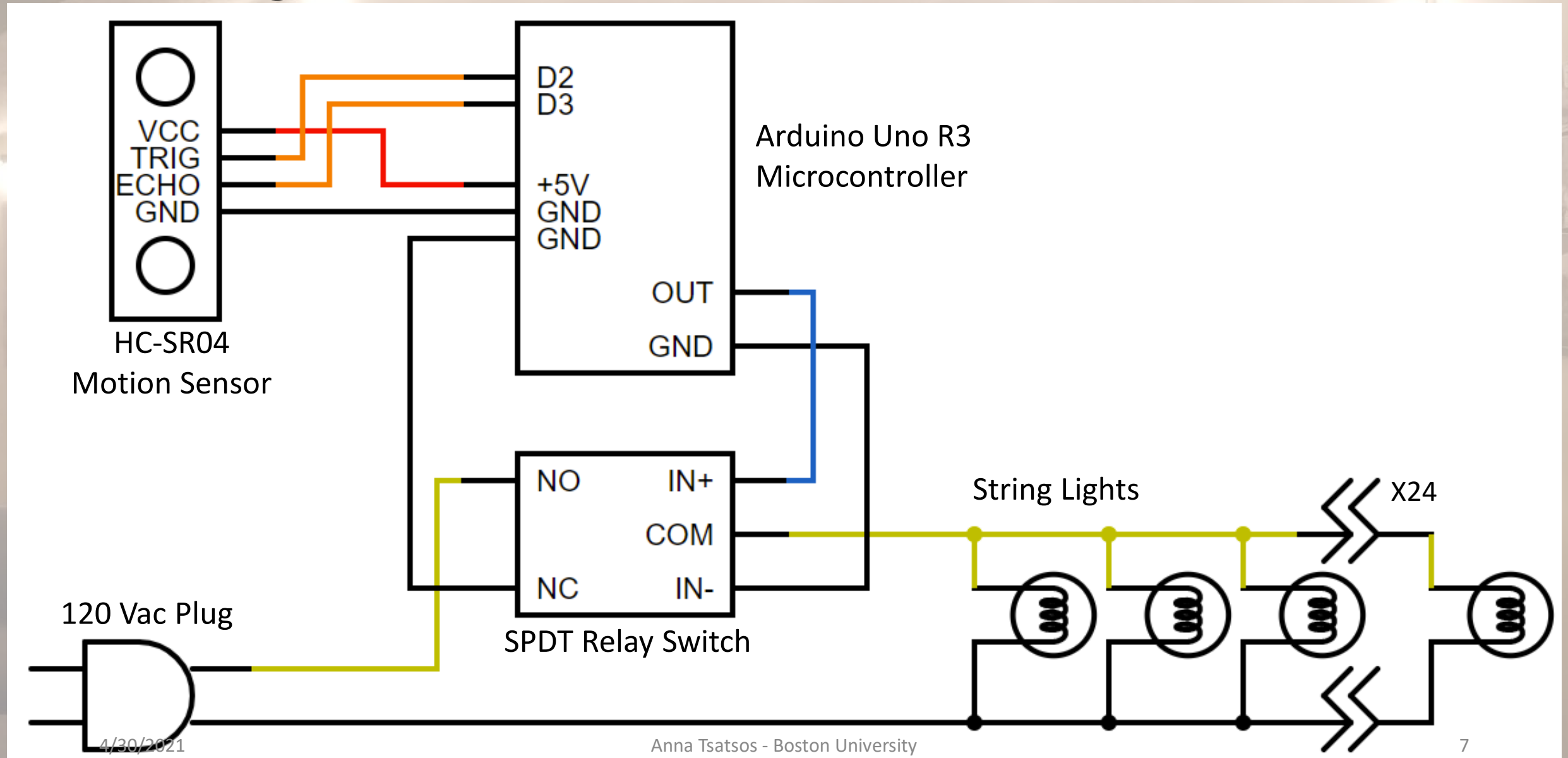
Flowchart


Motion Sensor Emits Ultrasonic Wave
Wave bounces off object
Motion Sensor Receives Back Ultrasonic Wave
Elapsed time in µs
Arduino converts input duration to centimeters.
Is the distance between the object and the sensor less than 10 cm?
No…
Yes!
Nothing occurs. Lights and relay remain as they were.
Someone just swiped! Arduino outputs into relay. Relay and lights are toggled.
Wait one second before continuing…

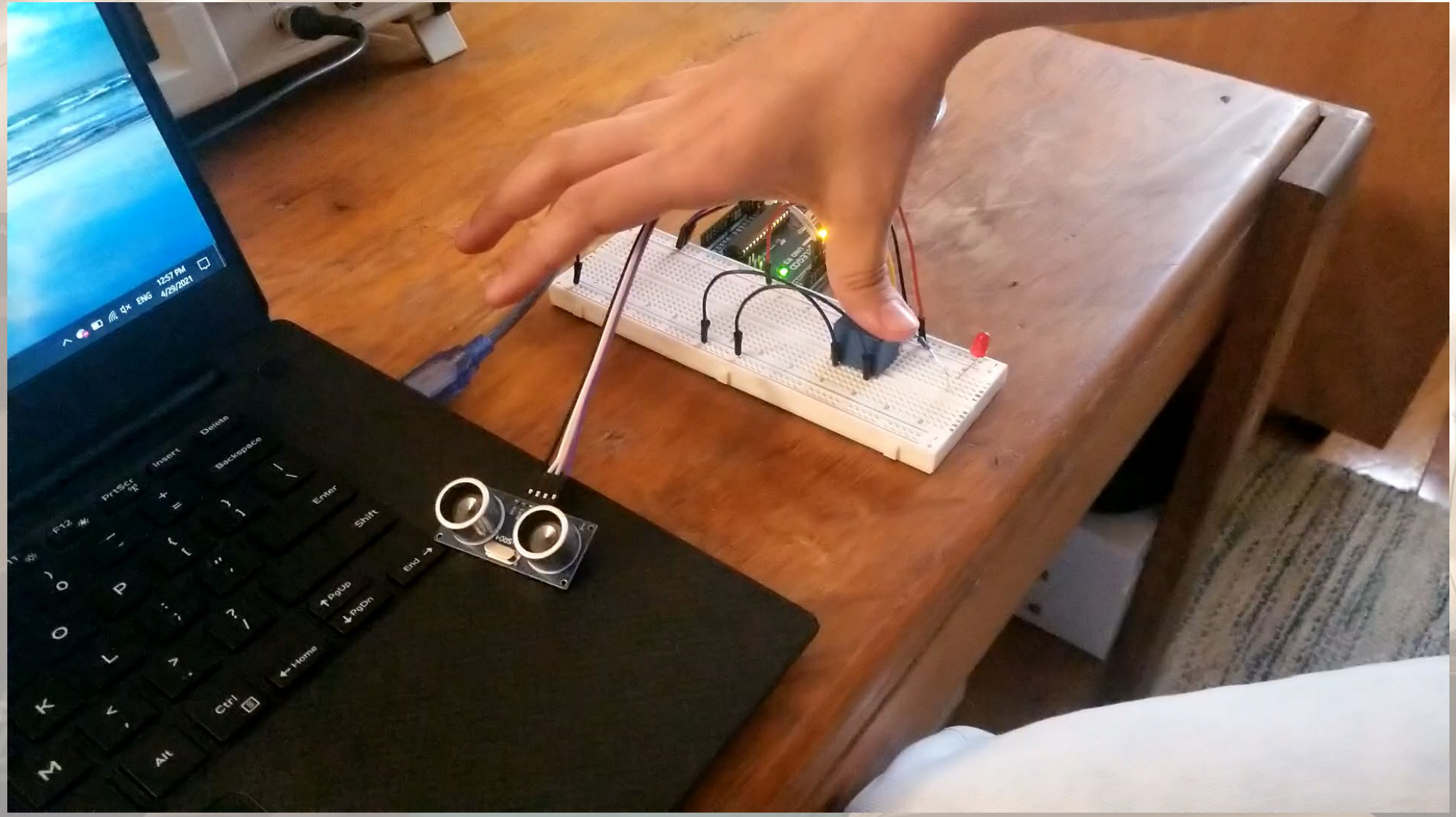
Schematic


Distance Input
(µs -> cm)
Arduino Uno R3 Microcontroller
HC-SR04 Motion Sensor
Arduino
Digital Output
120 Vac Plug
String Lights
SPDT Relay Switch

Wiring

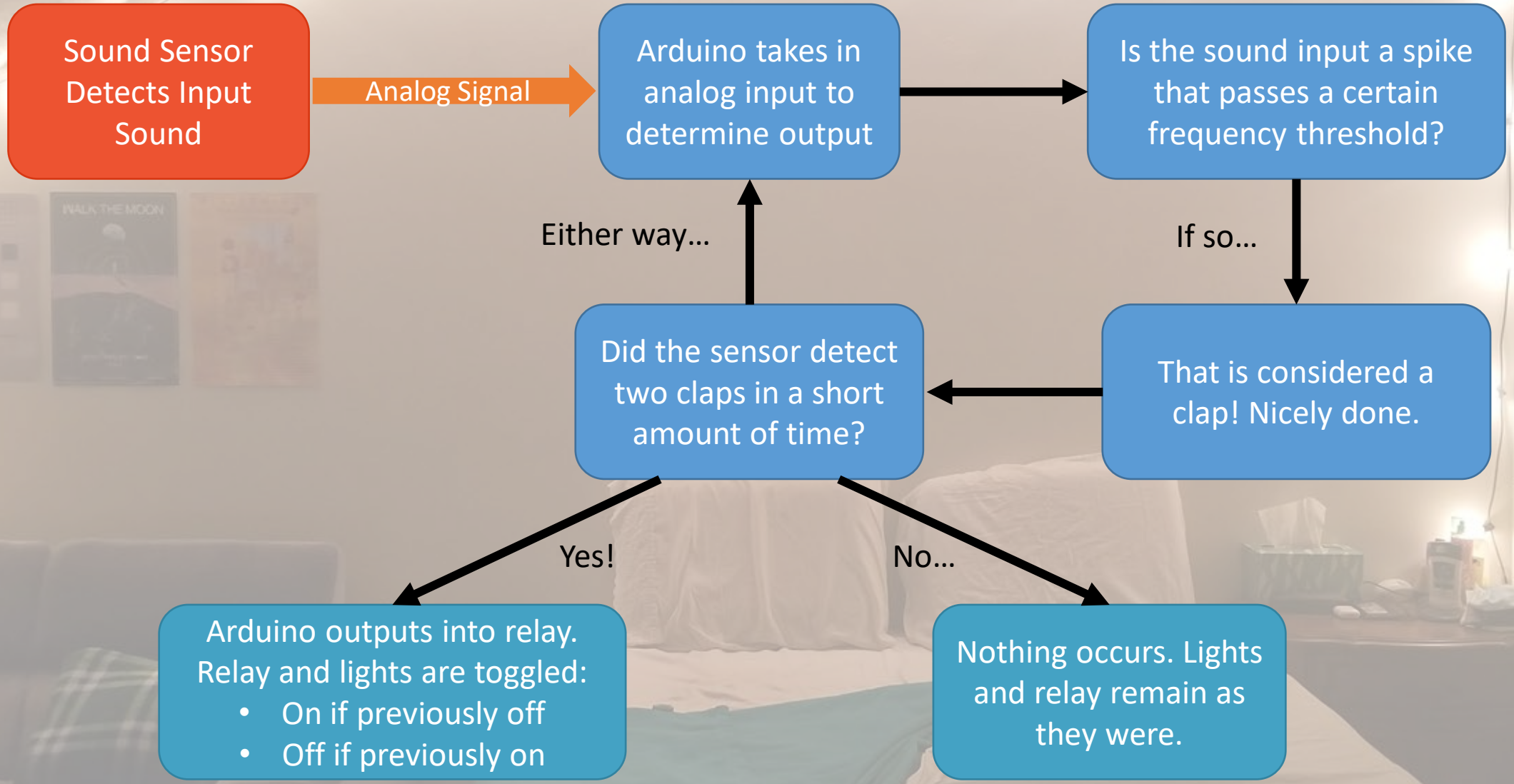

VCC
TRIG
ECHO
GND
HC-SR04
Motion Sensor
D2
D3
+5V
GND
GND
OUT
GND
Arduino Uno R3
Microcontroller
NO
IN+
COM
NC
IN-
SPDT Relay Switch
String Lights
X24
120 Vac Plug

Application (Demo)

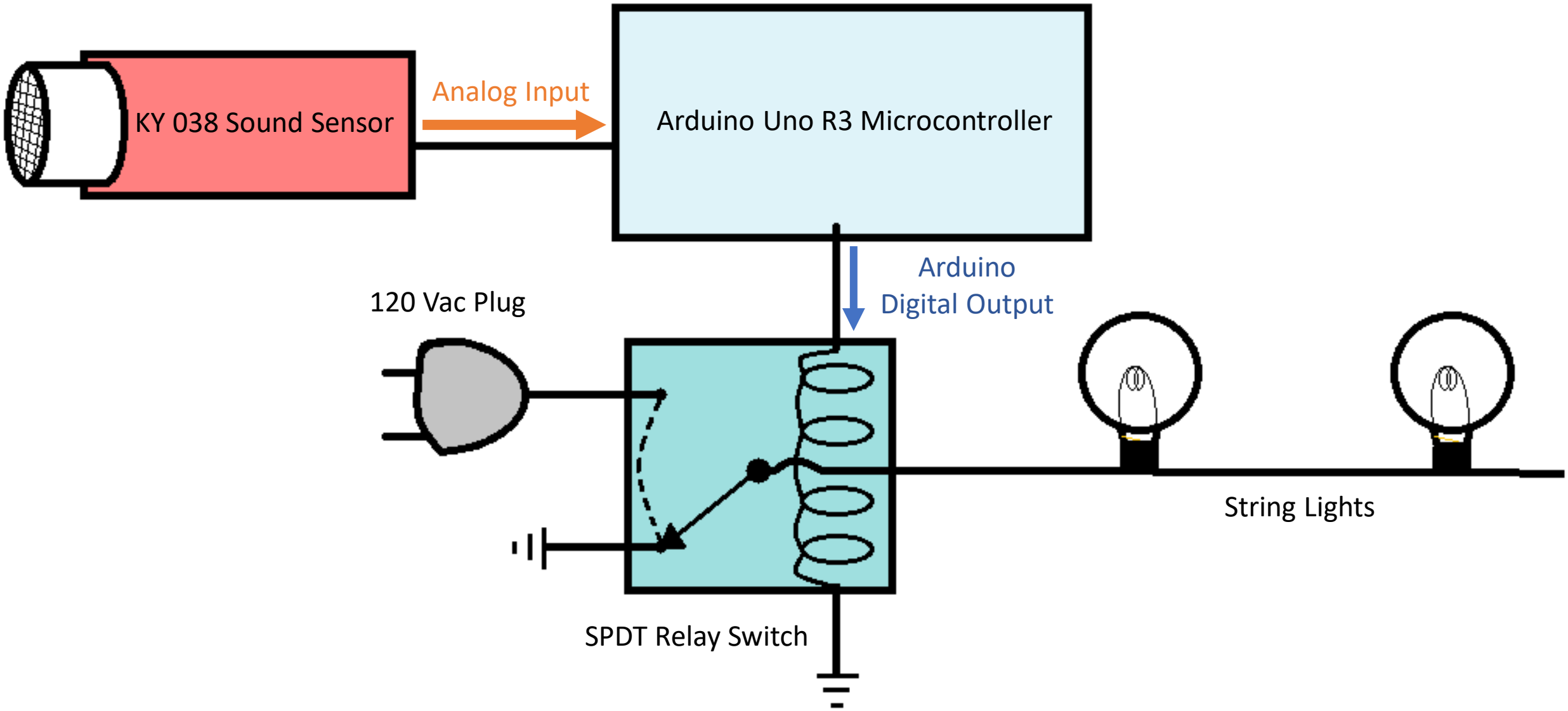


First Idea: Using Claps to Turn on my Electricity

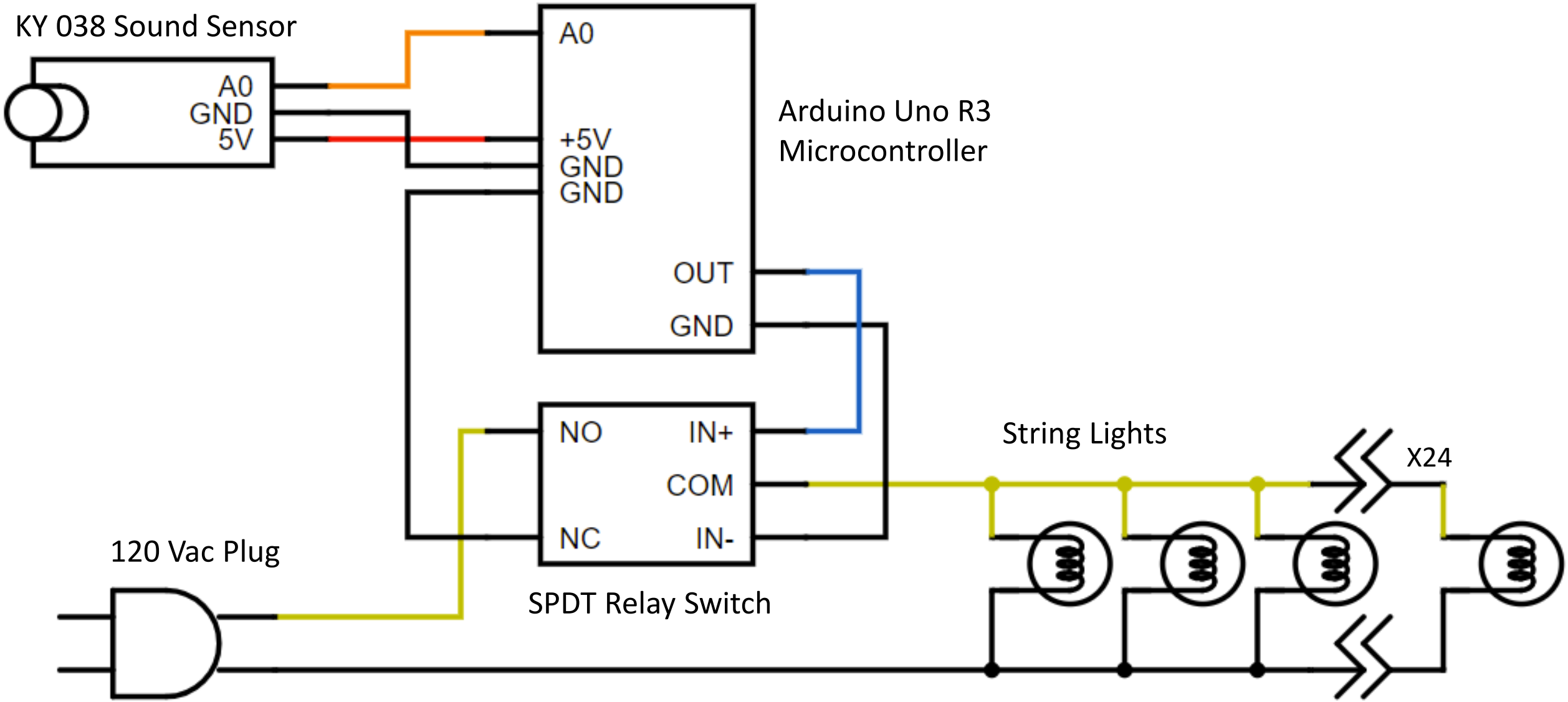
Flowchart


Sound Sensor Detects Input Sound
Analog Signal
Arduino takes in analog input to determine output
Is the sound input a spike that passes a certain frequency threshold?
If so…
That is considered a clap! Nicely done.
Did the sensor detect two claps in a short amount of time?
Either way…
Yes!
No…
Arduino outputs into relay. Relay and lights are toggled:
• On if previously off
• Off if previously on
Nothing occurs. Lights and relay remain as they were.

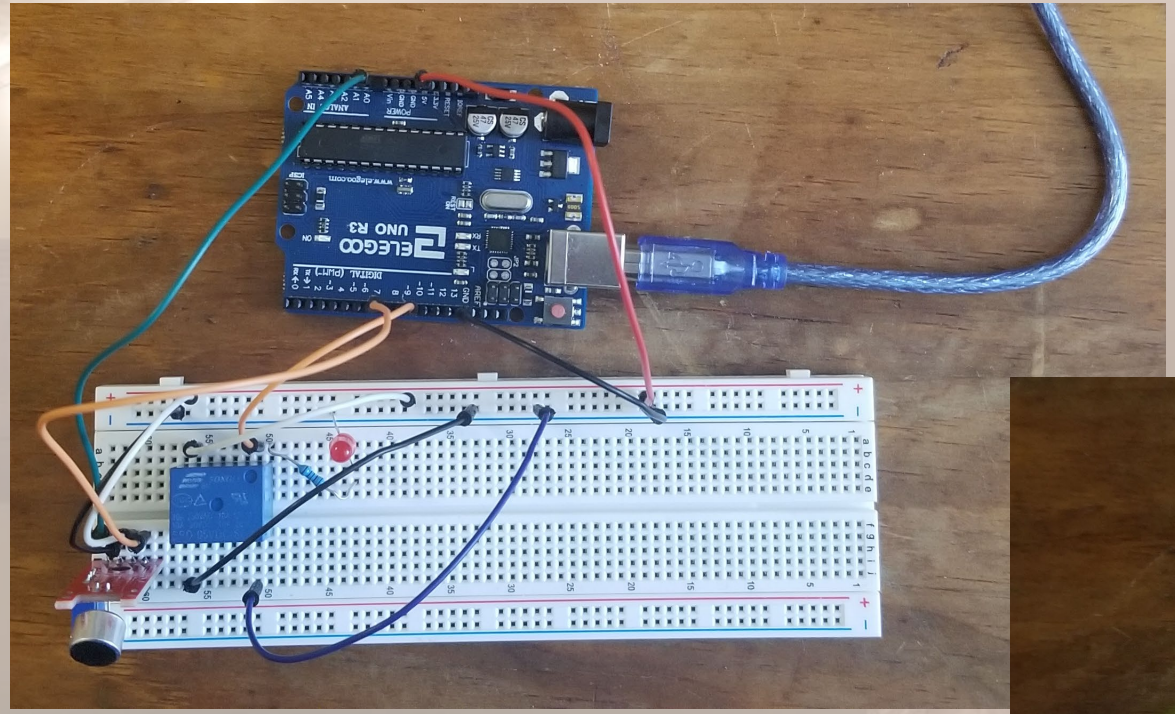
Schematic

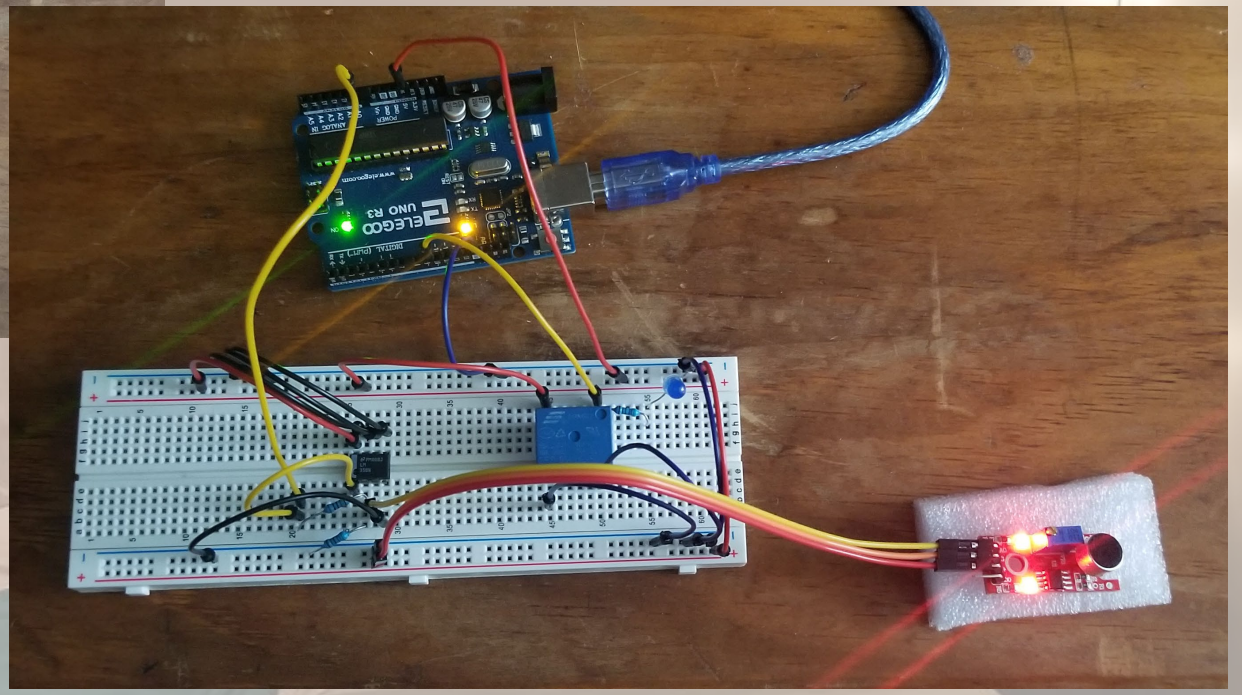

KY 038 Sound Sensor
Analog Input
Arduino Uno R3 Microcontroller
Arduino
Digital Output
120 Vac Plug
String Lights
SPDT Relay Switch

Wiring

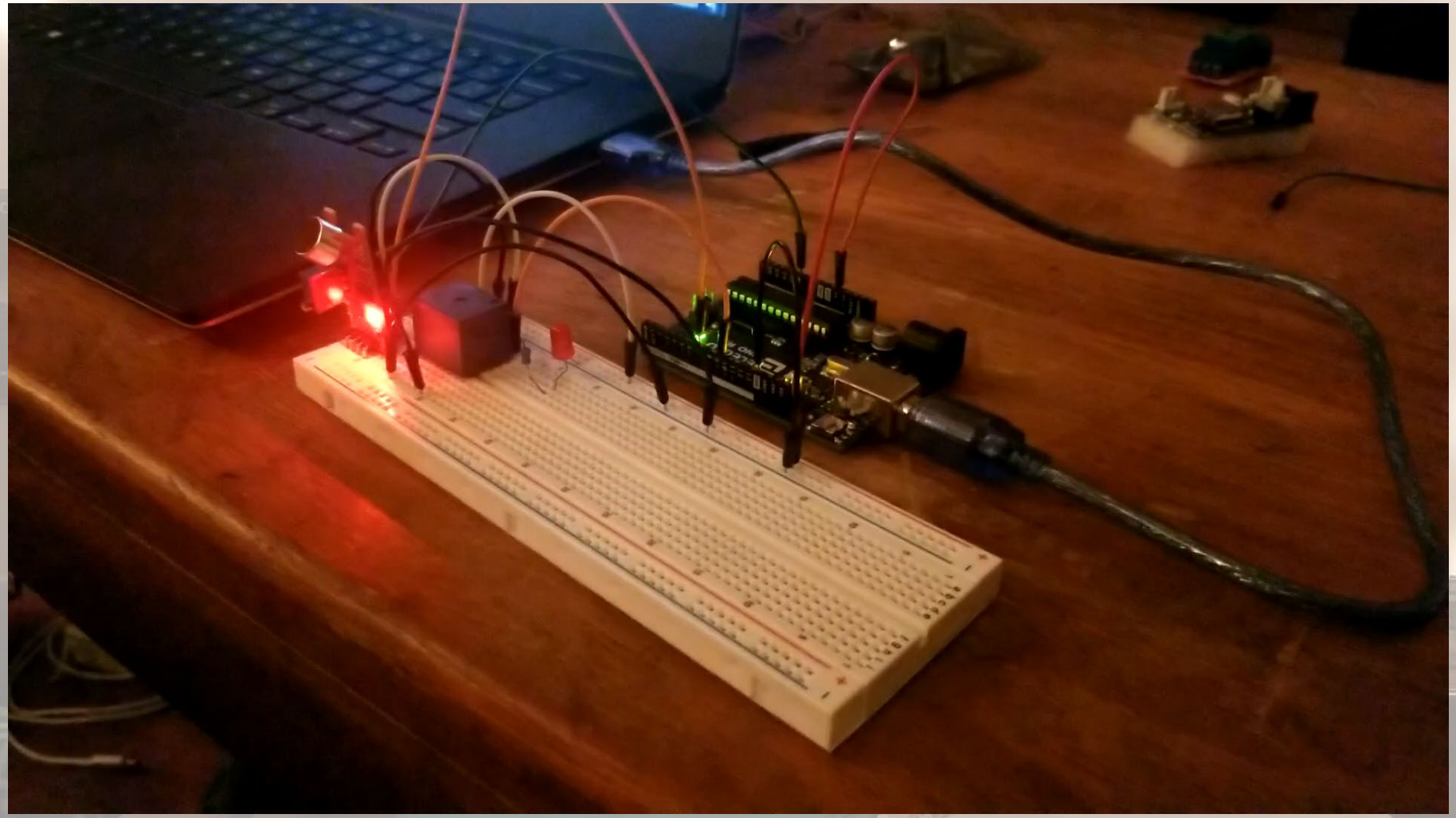

KY 038 Sound Sensor
A0
GND
5V
A0
+5V
GND
GND
Arduino Uno R3
Microcontroller
OUT
GND
NO
IN+
COM
NC
IN-
SPDT Relay Switch
String Lights
X24
120 Vac Plug

Progress

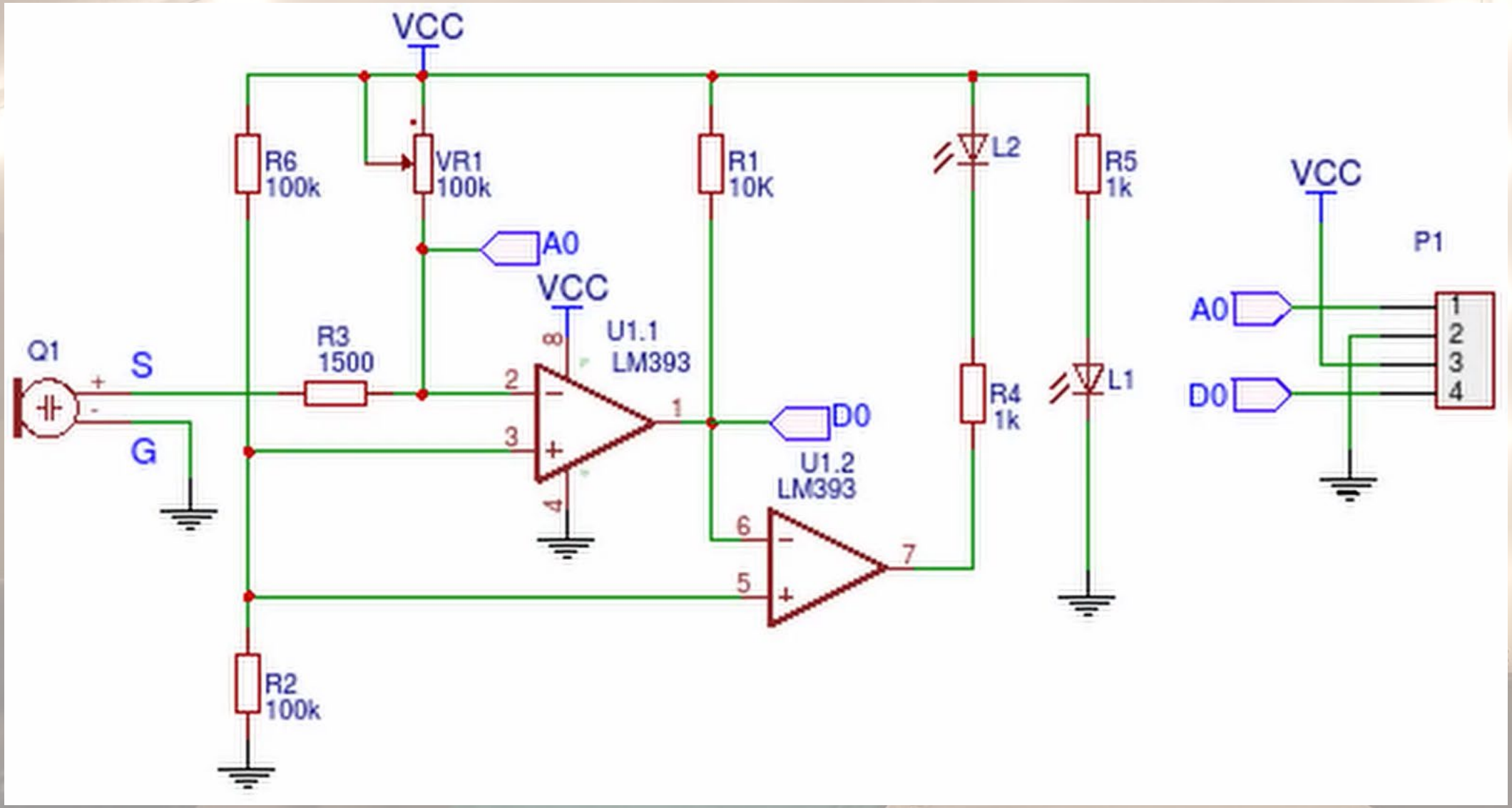




Progress



KY-038 Sound Sensor Schematic



Debugging

- While a clap does generate a spike in amplitude when looking at 20mV scales, other noise is picked up by the sound sensor.
  - On the oscilloscope, noise is shown to have frequency in MHz, in addition to 20mV, 60Hz hum.
  - Is the noise due to a corrupted Arduino? My laptop? An antenna? Clock speed?
- Implementing a band pass filter to isolate the frequency of a clap could filter out unwanted noise in the Hz and MHz scale.

Debugging

Thank you!